

## OCCUPATIONAL EXPOSURE

### Worker Activities

Worker activities at automobile refinishing shops include wet sanding, car washing, stripping (paint removal), machine sanding, blowing, buffing, polishing, paint spraying, paint and primer mixing, and inspection (Pfanstiehl, 1992). In contrast, worker at or near automobile OEM painting operations operate robotics painting equipment, perform mixing, clean paint booths, inspect vehicles, and perform manual "touch-up" painting. It is expected that manual touch-up painting operations would be conducted in spray booths, allowing minimal or no over spray to other sections of the plant.

### Number of Workers/Site

EPA found that a typical automobile refinishing shop employs 4 employees in production (BSB, 1995)<sup>1</sup>. The number of production employees ranges from 1.9 to 10.1, on average depending on shop size, with an overall average for all shops of 3.88. EPA estimated that at new automobile manufacturing facilities, 17 workers are involved in manual "touch-up" painting.

EPA found no information indicating that other workers in painting operations would be potentially exposed to polyisocyanates (USEPA, 1994b).

### Inhalation Exposure

EPA found exposure data specific to the automobile refinishing industry for both total mist levels during spray painting, and isocyanate levels during spray painting. The data, presented in Appendix B represents a variety of engineering controls and spray gun types. The data show a lowering of worker exposure to isocyanate in downdraft paint booths compared with crossdraft

---

<sup>1</sup>The BSB data was compiled from the results of a voluntary survey sent to 4,000 body shops in early 1995, of which 1,662 were returned. Not every shop answered every question, so the actual number of respondents to a particular question is unknown, but much less than 1,662. The distribution of 1994 sales from the BSB survey is comparable to 1992 Department of Commerce data for SIC 7532 (top, body, and upholstery repair shops and paint shops). Due to different presentation methods between the two sources, more exact comparisons are not possible:

<u>Annual Sales, thousands</u>	<u>BSB</u>	<u>DOC (Dept. of Commerce)</u>
< \$125		} 29 %
\$125-250	21 %	
\$250-350	13 %	} 41 %
\$350-750	21 %	
750-1,000	7 %	
> 1,000	9 %	7 %

booths. The data also show a lowering of isocyanate exposure when using HVLP spray guns as compared to conventional spray guns. The data are summarized as follows:

Scenario 1. *Crossdraft booth and conventional spray gun* (Crossdraft hood with paint spray filters or waterfall and air atomization paint-spray gun) Estimated 8-hr time weighted average (TWA) concentration range 0.1-18.4 mg/m<sup>3</sup> (Janko, 1992 and Lesage, 1992).

Scenario 2. *Downdraft booth and conventional spray gun* Estimated 8-hr TWA concentration range 0.1-5.7 mg/m<sup>3</sup> (Goyer 1995 and Lesage, 1992).

Scenario 3. *Crossdraft booth and HVLP spray gun* Estimated 8-hr TWA concentration range 1.0-5.2 mg/m<sup>3</sup> (Rudzinski 1995).

Scenario 4. *Downdraft booth and HVLP spray gun* Estimated 8-hr TWA range 0.5-1.5 mg/m<sup>3</sup> based on paint mist data (Heitbrink, 1995). This is based on the assumption that approximately 30% of particulate over spray is from a polyisocyanate for a typical HDI based paint system (Rudzinski, 1995).

The percentage of refinishing shops using downdraft booths is 30%, using crossdraft booths is 50%, and those using HVLP guns is 64% (BSB, 1995). In comparison, more than 90% of the spray booths in 15 OEM plants surveyed were downdraft (USEPA, 1994b).

## **Dermal Exposure**

EPA did not find any data specific to dermal exposure in the automotive industry. EPA uses data developed from other activities to estimate dermal exposures during mixing, painting, etc.

## APPENDIX B

### SPRAY PAINT EXPOSURE SUMMARIES FOR ISOCYANATES

Industry	Isocyanate Sampled	Eng controls/ gun type	Activity Description	Airborne Concentration (mg/m <sup>3</sup> )	Reference
Automobile painting (crash repair workshop)	Active isocyanate	none/NA	Paint mixing & Spray gun washing	0.001 (P) (# of samples not provided)	Pisaniello & Muriale, 1989 (#10)
Automobile painting (crash repair workshop)	Active isocyanate	none/NA	Dry rubbing with mechanical sander (when new coat is few hours old)	0.006- 0.02 (P) (#=2) sample periods were approx 18 min duration	Pisaniello & Muriale, 1989 (#10)
USAF Automobile & Miscellaneous parts	HDI	crossdraft/ HVLP	Spray painting of large vehicles and objects	0.017-0.22 (P) (#=2) 0.004-0.14 (A) (#=4) sample period not reported	Rudzinski et. al., 1995 (#12)
Keesler AFB	N-75 (aliphatic polyisocyanates)	crossdraft/ HVLP	Spray painting trucks	1.0-1.9 (P) (#=2) 1.6-4.1 (A) (#=4) sample period not reported	Rudzinski et. al., 1995 (#12)
Langley AFB	N-75 (aliphatic polyisocyanates)	crossdraft/ HVLP	Spray painting aircraft ground equipment	4.7-5.2 (P) (#=2) 4.9-13.9 (A) (#=4) sample period not reported	Rudzinski et. al., 1995 (#12)
Car Paint Shops	Oligomer HDI	downdraft/ conventional	Spray paint operations (measured at various heights above floor)	5 in. - 2.6 (A) 32 in. - 2.9 (A) 43 in. - 1.9 (A) 55 in. - 1.4 (A)	Lesage et al, 1992 (#53)
USAF vehicle painting	TDI	crossdraft/ conventional	Spray painting operations	3.0 (P) (#=3) sample period not reported	Dept. of the Army Medical Command, 1996 (#69)
Paint Manufacturing & Application Operations using PUR coatings	HDI and HDI- based polyisocyanates	no information	Transportation Aftermarket	0.0006-0.015 (P) (geometric mean = 0.03) (# =35) sample period not reported	H.E. Myer et al, 1993 (#70)

Industry	Isocyanate Sampled	Eng controls/ gun type	Activity Description	Airborne Concentration (mg/m <sup>3</sup> )	Reference
Car Spray painting	HDI polyisocyanate	Downdraft/ no info	Spray painting	0.25 - 3.0 (P) (#=12) sample period not reported	Maitre et al, 1996 (#54)
Paint Manufacturing & Application Operations using PUR coatings	HDI	no information	Heavy Equipment/Military	0.04 (geom mean) (#=25)(P)	H.E. Myer et al, 1993 (#70)
Paint Manufacturing & Application Operations using PUR coatings	HDI	no information	Maintenance/Construction	0.05 (geom mean) (#=16) (P)	H.E. Myer et al, 1993 (#70)
Paint Manufacturing & Application Operations using PUR coatings	HDI	no information	Wood/Furniture	0.02 (geom mean) (#=11) (P)	H.E. Myer et al, 1993 (#70)
Industrial Spray Operations	HDI monomers & HDI polyisocyanates	crossdraft/ conventional	Spray Painting & Related Operations	HDI monomer 0.007 (P) (geom mean) (#=24) HDI polyisocyanates 0.70-12.2 (P) (geom mean =3.87) (#=24)	M. Janko et al, 1992 (#76)
Auto Body Shops	HDI monomers & HDI polyisocyanates	crossdraft/ conventional	Spray Painting & Related Operations	HDI monomer 0.014 (P) (geom mean) (#=55) HDI polyisocyanates ND-18.4 (P) (geom mean =1.60) (#=55)	M. Janko et al, 1992 (#76)
Spray Finishing of Large Objects	HDI monomers & HDI polyisocyanates	crossdraft/ conventional	Spray Painting & Related Operations	HDI monomer 0.007-0.11(P) (#=31) HDI polyisocyanates 2.09-15.9 (P) (#=31)	M. Janko et al, 1992 (#76)
Auto Refinishing	HDI Oligomer	downdraft/ no info		0.1-2.16 mg/m <sup>3</sup> sample period two	(#91)

P = personal sample

A = area sample

# = No. Samples collected